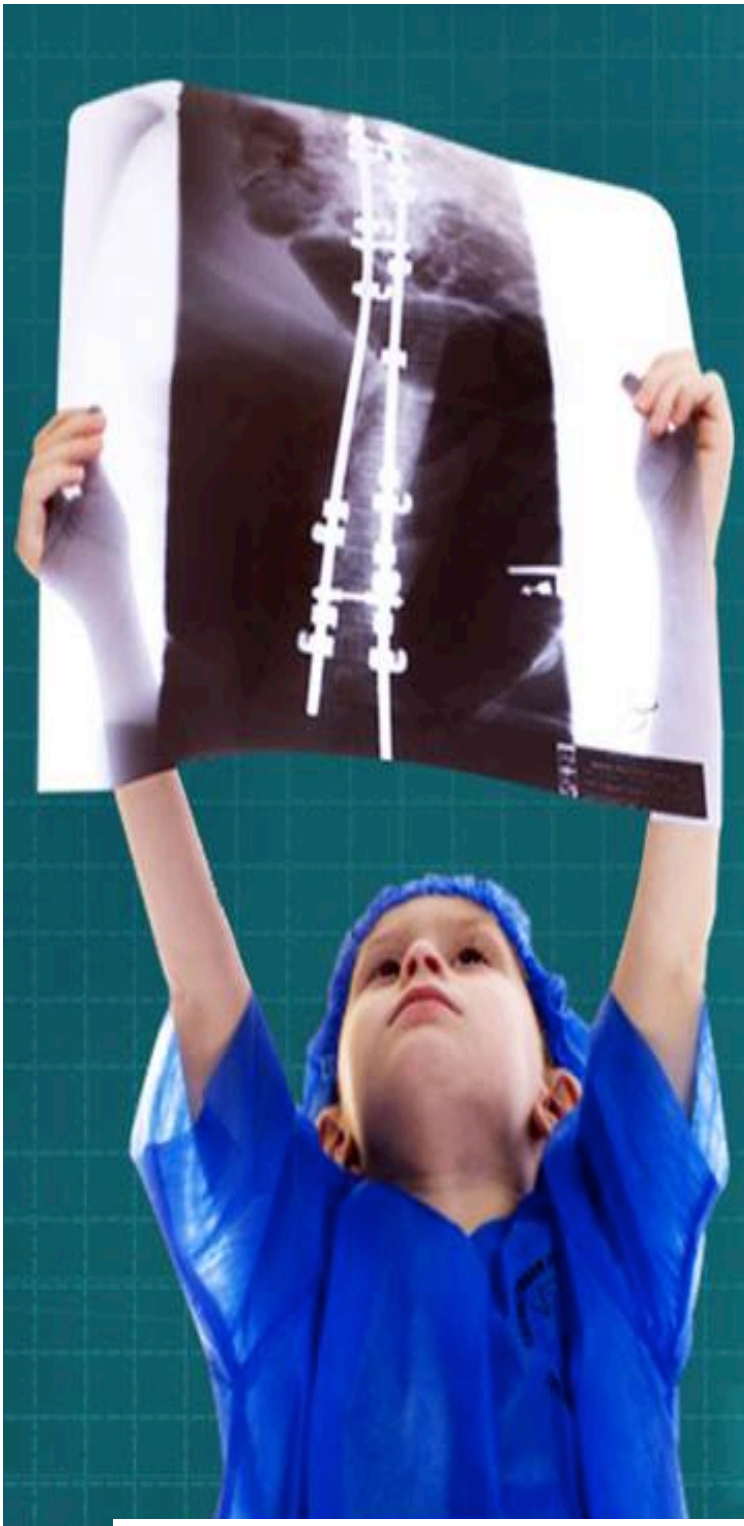

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Radiology Team

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Lecture 2: Contrast Media and Safety in Radiology

Done By: Lama AlShwairikh

◆Important ◆Doctor's notes ◆Team's notes

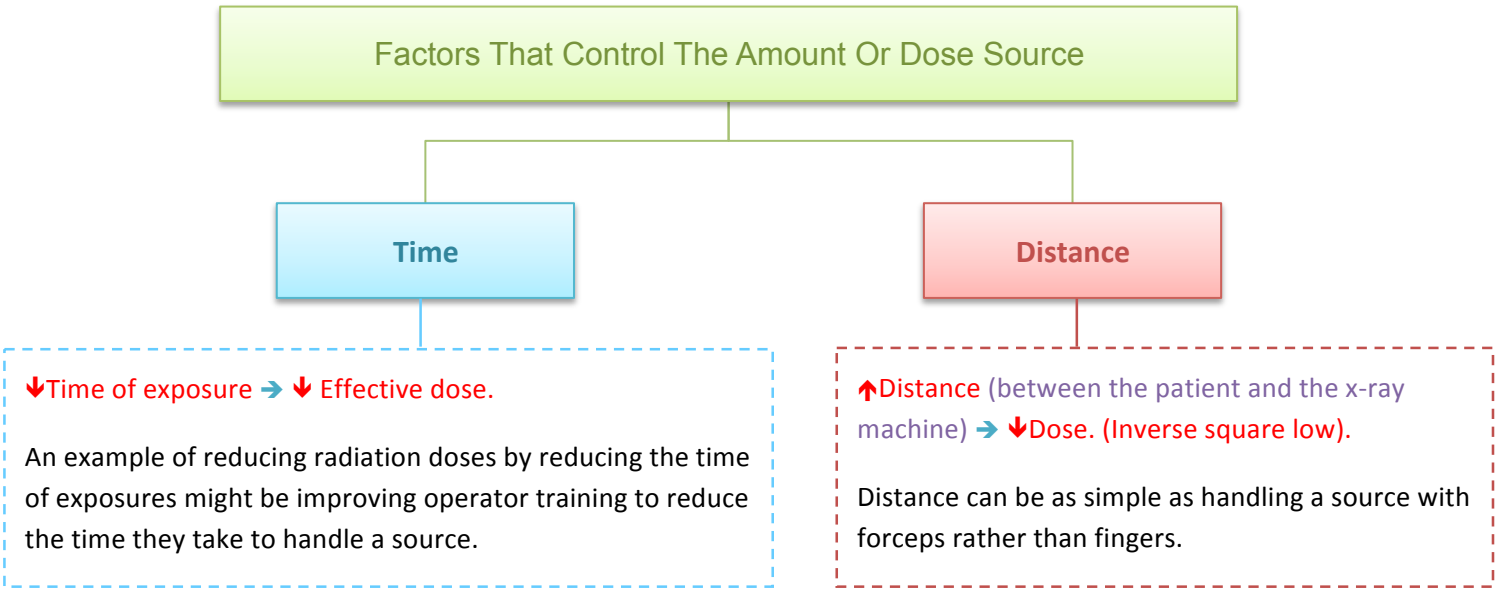
We thank 430 Team for their helpful notes

Objectives:

1) Radiation safety. 2) Contrast agent.

Radiation safety: shielding:

- Operators view the target through a leaded glass screen.
- Almost any material can act as a shield from gamma or x-rays if used in sufficient amounts.
- If they must remain in the same room as the target, wear lead aprons and thyroid collar.
  (All health care workers exposed to radiation must take these precautions, like surgeons, gastroenterologist and cardiologists, not just radiologists.)
  (Mostly in fluoroscopy and interventional radiology procedures.)
- Standard 0.5mm lead apron.
- Protect you from 95% of radiation exposure.



Radiation Risk		
	Stochastic effect	**Deterministic effect**
Related to	Accumulative Amount of exposure. (The more the exposure, the higher the risk. i.e. no specific dose to cause the effect)	Thresholds level. (Certain amount of exposure would cause the effect)
Possible side effects	1) Carcinogenic effect. 2) Genetic effect.	1) Cataract. 2) Bone marrow failure. 3) Erythema. 4) Lung fibrosis.

Deterministic effect:

Level >2-3 GRAY RANGE (Gray is the unit of exposure of radiation)

One chest X-ray is 0.15 mGRAY = 10000 chest x-ray = 100 CT abdomen = 30 mins to 1 hr fluoroscopy exposure

(Fluoroscopy has the highest exposure) (This is just to compare exposure in different modalities)

ALARA rule: As Low As Reasonably Achievable

- Reduce number of exams. (Usually, there's a 48-hour interval between 2 procedures, unless the case is an emergency).
- Reduce time of exam.
- Use alternatives if possible (E.g. If possible, do an US or an MRI instead of a CT scan)

Background Radiation: (Radiation in the universe)

1) Natural radiation. 2) From outer space. 3) From radon gas.

Average annual dose:

- General population: 3.2 milli-sievert.
- Radiologist: 0.7 milli-sievert.
- Technologist: 0.95 milli-sievert.
- Sievert is effective radiation dose (absorbed dose).

If a patient presented to the ER with trauma, we'd do a skull CT to detect a fracture, not x-ray. Although radiation is higher in CT, we'd get a clear image from the first time. However, if we order an x-ray, we might need to do it again or order a CT, which means double exposure. Also, other finding such as hematoma can't be detected by x-ray.

Equivalency To Natural Background Radiation	
Abdominal region	
Computed Tomography (CT) Abdomen	3 Years
Computed Tomography (CT) Body	3 Years
Intravenous Pyelogram (IVP)	6 Months
Radiography-Lower GI Tract	16 Months
Radiography-Upper GI Tract	8 Months

Radiation dose	
Investigation	RISK/ PA CHEST X-RAY (0.03 m SV)
Lumbar Spine	100
Abdomen	50
IVU	150
Ct Head	100
Ct Chest	300
Ct Abdomen	400
Bone Scan	200

Another example. CT abdomen is preferred over IVU in some cases. Because after ordering IVU, you might still need to order a CT abdomen (150+400=550). However if you only order CT, the exposure will be less (400)

Oral Contrast

Gastrographine

In CT study (diluted gastrographine) (water soluble)
(Iodine is used because it absorbs x-ray)

Main indication: bowel perforation.

Contraindication:
If there is a risk of aspiration or fistula between the esophagus and the trachea (The possible complication is chemical pneumonitis)

Barium

Barium meal, swallow and enema.
(Not water soluble)

Indication: GI study

Contraindicated if there's: perforation or toxic mega colon. (The possible complication is chemical peritonitis or toxic mega colon)

Double contrast:
Contrast + air

Used to see:
The lumen

In cases such as:
Ulcerative colitis and crohn's disease

How to know if there's bowel perforation:
X-rays of the chest or abdomen will show air in the abdominal cavity, called free air.

MRI Contrast:

- Expensive.
- We are giving 0.1 m mol/kg.
- Reaction was described on MR contrast (Gadolinium). But much less than CT contrast.
- If contrast is given in chronic renal failure, it could cause nephrogenic systemic fibrosis.

Nephrogenic Systemic Fibrosis (NSF):

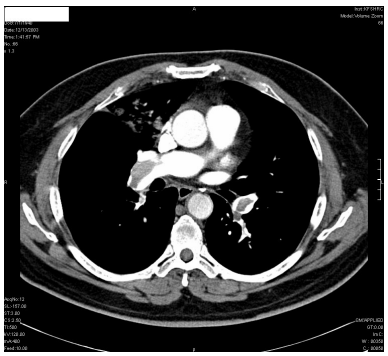
- A rare and serious syndrome that involves fibrosis of skin, joints, eyes.

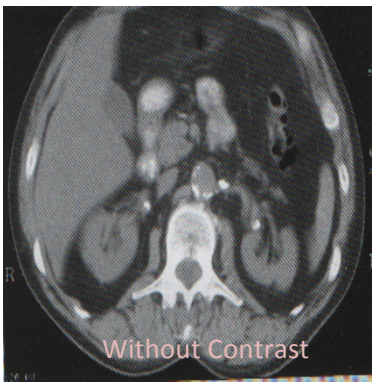
(Skin erythema, stiffness of the limbs)

- Most patients with NSF would undergo hemodialysis for renal failure. (After the study)
- NSF may also cause joint contractures resulting in joint pain and limitation in range of motion.
- Treatment: Currently, there is no effective treatment for nephrogenic systemic fibrosis.

CT Scan:

To detect pulmonary embolism, IV contrats must be given rapidly. However, doing that in addition to not allocating the IV access properly would result in contrast extravasation. (a leakage of contrast material into the fatty tissue around a vein). Necrosis is a possible complication.
Management: Elevating the affected extremity above the heart and applying cold compresses topically.





Contrast Media Reaction:

Case 1:

A 45-year-old patient had the following symptoms and signs after triphasic CT of the liver:
RR= 30/min (tachypnea)
BP= 80/40 mmHg (hypotension)
Pulse rate= 125/min (tachycardia)

Status: Lethargic.
RR: 28/min (tachypnea)
BP: 70/40 mm Hg (hypotension)
Pulse: 130/min (tachycardia)
Chest: Some expiratory wheezes

(Management is explained in the last page)

Contrast media:

Take precaution before giving contrast agent in these cases:

1) Previous reaction.
2) Asthmatic patient.
3) Renal impairment. (Might cause acute renal failure).
(So creatinine levels must be checked before doing the study)
4) DM. (If the patient is on glucophage (metformin), it should be stopped prior/after the study)
5) Atopic dermatitis.
6) Pregnancy.
7) Sickle cell anemia.
8) Multiple myeloma.

Types of reaction:

Reactions can range from minor to severe, sometimes resulting in death with death being about 0.9 per 100,000 cases.

1) Mild: nausea & vomiting.
2) Moderate: skin reaction and bronchospasm.
3) Severe hypotension. (With tachycardia or bradycardia)

IV contrast media misconception:

A common misconception that even exists among healthcare professionals is that an allergy to contrast media is related to an allergy to seafood (usually shellfish) because both share iodine in common, implicating iodine as a source.

Contrast Reactions Guide For All Cases:

- Always follow BLS and ACLS Guidelines.
- Remember your ABCs (Airway, Breathing, Circulation).
- Call for help (EMT/code team).
- Whenever epinephrine is administered, consider cardiac contraindications.
- For pediatric patients, remember appropriate medication dosing (typically weight based).
- Possible reaction is urticaria. If it occurs:
    - Discontinue contrast administration.
    - Usually, no treatment needed. (antihistamines could be given)
- Mild to Moderate Reaction: Benadryl 25-50 mg PO/IM/IV (adult dosing). advise patient not to drive home alone after treatment; Pediatric Dose is 1 mg/kg up to 50 mg. (Important according to females' doctor. Dr. AlBadr said "I don't expect from you to know the doses.")
- Severe Reaction: Epinephrine SC (1:1000) 0.1-0.3 mL (equivalent to a dose of 0.1-0.3 mg).

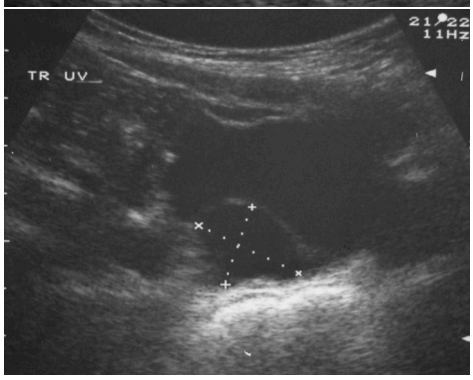
Management of Bronchospasm (Moderate reaction):

- Oxygen (6-10L/min)
- Give beta agonist inhalers (Albuterol, bronchodilators).
- Epinephrine SC (1:1000) 0.1-0.3mL (equivalent to 0.1-0.3mg).
- If hypotension, give Epinephrine (1:10,000) 1mL slowly IV (equivalent to 0.1mg) and up to 1 mg as needed.

Management of severe reaction: (The question will be a scenario case)

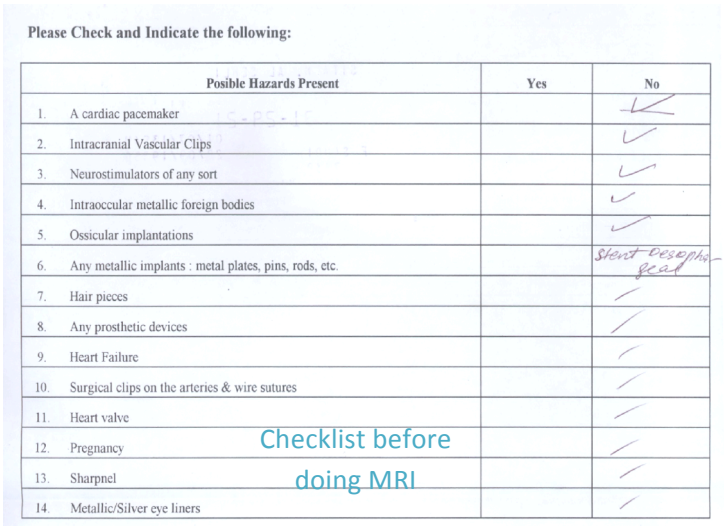
Hypotension with Tachycardia	Hypotension with Bradycardia (Vasovagal Reaction)
Trendelenburg position or elevate legs.	Trendelenburg position or elevate legs.
Oxygen (6-10L/min).	Oxygen (6-10L/min).
Rapid bolus of large volumes of normal saline (NS) (Treat hypotension).	Rapid bolus of large volumes of normal saline (NS) (Treat hypotension).
If poorly responsive, give Epinephrine (1:10,000) 1mL slowly IV (equivalent to 0.1mg) and up to 1 mg as needed.	IV placement, Monitor (Rhythm, Blood Pressure, Pulse Oximetry), and EKG. (To rule out cardiac arrest)

Case 2: Intravenous pyelography (intravenous urography) + Ultrasound. The diagnosis here is ureterocele.
(A cystic out-pouching of the distal ureter into the urinary bladder)



Can we do MRI for a pregnant patient?
Yes, but only after the first trimester

Major contraindication:
Metallic implements



Please Check and Indicate the following:

	Posible Hazards Present	Yes	No
1.	A cardiac pacemaker		✓
2.	Intracranial Vascular Clips		✓
3.	Neurostimulators of any sort		✓
4.	Intraoccular metallic foreign bodies		✓
5.	Ossicular implantations		✓
6.	Any metallic implants : metal plates, pins, rods, etc.		Stent Oesopha- geal
7.	Hair pieces		✓
8.	Any prosthetic devices		✓
9.	Heart Failure		✓
10.	Surgical clips on the arteries & wire sutures		✓
11.	Heart valve		✓
12.	Pregnancy		✓
13.	Sharpnel		✓
14.	Metallic/Silver eye liners		✓

Checklist before doing MRI